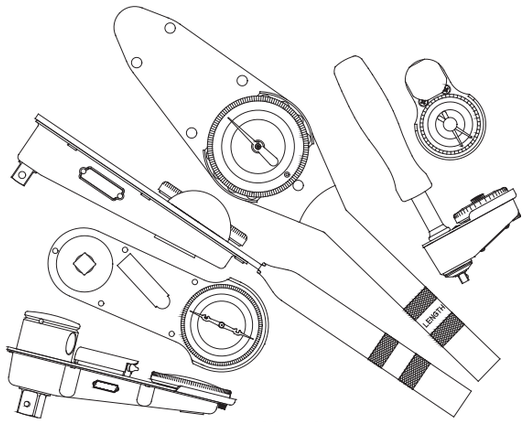
PRECISION INSTRUMENTS

User Manual



Features and Benefits

★ **Extremely Accurate** ◆Accurate within 2% of reading from 20% of full scale to full scale. Guaranteed against defect in workmanship and materials for one year from the date of delivery providing that they have been used according to instructions.

★ **Exclusive Torsion Bar Design** ◆This patented design features a connecting arm directly from the square drive to the easy-to-read dial. This enables the user to read the actual twist of the square drive. And, since a lever principle isn't used, hand-hold position is not critical, unlike the split or bending beam competitive torque wrenches.

★ **Compact Design and Tapered Nose** ◆This provides ease-of-operation by allowing clearance where operating space is limited.

★ **Large Shock Resistant Dials** ◆Protected by dial "guards", the large easy-to-read dial numbers are set off against a contrasting color. With many increments on the scale, guess work is eliminated.

★ **Dial Pointers** ◆Work in either right or left-hand direction. The dial can also be rotated so the user can torque to zero from the desired value.

★ **Memory Needle Models** ◆Retain the highest torque reading for easy reference. For Quality Control testing, a Memory Needle Model displays the maximum reading obtained. This is excellent for verifying production torque applications.

★ **Indicator Light Models** ◆Indicates when a preset torque level is achieved. Set the dial to the required torque, and the light will go on when the proper torque is reached. This is particularly useful when the dial is not visible.

★ **Shock-Resistant Dial Mechanism** ◆Built to withstand rough usage, the mechanism which provides the expanded dial readings is shock protected with resilient and overload members.

★ **Consistent Readings** ◆The accuracy is not affected by the way it is held. Pull on the end of the handle or close to the dial and the reading remains the same. Handle extensions are furnished with many models which allow even greater flexibility.

★ **Compact** ◆ The square drive is located at the very end of the torque wrench so that it can be used in areas where space is at a minimum.

★ **Friction-Free Operation** ◆A floating connecting beam between the torque measuring element and the dial mechanism has no bearing points and consequently there is no friction drag. This floating beam construction together with the precision of the dial mechanism renders the torque wrench practically friction-free.

★ **Accurate and Dependable** ◆ All Precision Instrument D Torque wrench Series meets or exceeds all applicable requirements of: ANSI / ASME B107.14M, GGG-W-00686C, BS6073: 1988, ISO6789.

TO GET ACCURATE TORQUE READINGS

Your torque wrench is a precision instrument. Given proper care it will give many years of satisfactory use. For best results and accurate readings follow the instructions given below.

1. Set the dial of the Torque wrench by using method "A" or "B" explained below. **Method A:** 1) Turn the dial until the pointer is on zero. 2) Place the Torque wrench on the fastener. 3) Pull until the pointer reaches the torque required. **Method B:** 1) Turn the dial until the pointer is at the torque required. (On right hand threads set to the left of zero. On left hand threads set to the right of zero.) 2) Place the Torque wrench on the fastener. 3) Pull until the pointer reaches zero.
2. To make it easier to read the dial of all except the Memory Needle models, it is possible to place the pointer in any desired position. Turn the dial until the pin bears against the pointer. Then turn the dial 1/4 turn past the position desired. Finally, turn the dial in the other direction. The pointer will follow the pin back until it reaches the position desired. Then proceed with either Method "A" or "B," as explained above.
3. To use the **Indicator Light Model** for clockwise applications, turn the dial until the gold pointer is set at the desired torque (the red pointer for counterclockwise applications). Place the Torque wrench on the fastener and pull until the light comes on. Check the bulb and battery if the light fails to light when the pointer touches the gold contact pin.
4. To use the **Memory Needle Model** in the clockwise direction, rotate knurled knob counter clockwise on top of crystal until Memory Needle contacts main pointer. Next turn the dial bezel counter clockwise until the Memory Needle is on zero. Place the Torque wrench on the fastener and pull on the wrench handle until the desired torque is reached. When the pressure is released the main pointer will return to zero and the Memory Needle will remain at the peak torque reached. For counter clockwise direction use, reverse above procedure.

The Memory Needle feature can be used to record peak torque when the Torque wrench dial may not be visible. Be careful not to overtorque the fastener or Torque wrench.

5. Each time the Torque wrench is used, be sure that the dial and pointer are set correctly.
6. After each use of the Torque wrench make sure the pointer returns to zero or the pre-set value. If not, re-set the dial and pull again.
7. For an accurate reading, the final turn of the nut should be made with the Torque wrench.
8. The hub of the pointer contains a clutch which allows the stem to turn within the hub if a sudden impact occurs. This important safety factor protects the dial mechanism from shock damage. If a fastener suddenly breaks, it may change the pointer setting. Reset the dial and proceed as before.
9. Work on fasteners with clean and lubricated threads.
10. Your Torque wrench does not need lubrication. Do not attempt to oil it.

TORQUE PRODUCTS FULL WARRANTY

PRECISION INSTRUMENTS WARRANTS THAT PRECISION TORQUE PRODUCTS ARE FREE FROM DEFECTS IN WORKMANSHIP AND MATERIALS. Precision Instruments will repair or replace these tools which fail to give satisfactory service due to defective workmanship or materials.

This warranty for Precision Instruments torque products is for ONE YEAR from the date of the original purchase. Repair or replacement shall be at the election and expense of Precision Instruments . Except where unreasonable, the product must be returned to Precision Instruments prepaid for warranty service. Precision Instruments does not provide any warranty for any product, or its calibration, subjected to abnormal use. Abnormal use includes misuse, modification, unreasonable use, neglect, lack of maintenance, lack of periodic calibration, or use after the tool is significantly worn.

PRECISION INSTRUMENTS SHALL NOT BE LIABLE FOR ANY INCIDENTAL, SPECIAL OR CONSEQUENTIAL COSTS OR DAMAGES INCURRED BY THE PURCHASER OR OTHER including, without limitations, lost profits, revenues, anticipated sales, business opportunities, goodwill, or interruption of business and any other injury of damage. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty is your exclusive remedy and is in place of all other rights and remedies. You may have other rights which vary from state to state or country.

Precision Instruments, Inc.
Warranty Information
P. O. Box 1306
Des Plaines, IL 60017

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Why Measure Torque

Modern consumer demand has forced industry to upgrade manufacturing efficiency. Because of this, manufacturers have expanded their production through special emphasis on such specifics as ''increased power per cubic inch,'' ''power per dollar'' and ''product efficiency factor per pound.'' In researching the need for increased product efficiency and the importance of complying with stringent safety standards, manufacturers found that the ''nuts and bolts'' principle needed special attention. Older products and machines were assembled using oversized parts having high safety factors and enormous strength. These assemblies required minimal attention, since nuts and bolts were much larger than necessary. In order to increase product efficiency per pound, smaller, more efficient machinery had to be produced using smaller yet stronger fasteners. Because of this, the ''nuts and bolts'' principles have new importance.

Threaded Fasteners

Threaded fasteners are used on all types of machinery, yet proper attention is often neglected. Improper torque can cause enough distortion to fracture castings, accelerate wear or cause running parts to seize. It is a known fact that a simple half-inch bolt may exert a force as high as 16,000 pounds-enough force to lift four or five automobiles. Quite obviously, threaded fasteners require special attention. Because of the importance nuts and bolts play in product efficiency, the Society of Automotive Engineers has established standards of minimum tensile strength for all major classes of threaded fasteners used by industry. Actually, the minimum tensile strength is only potential, considering practical usage. Because fasteners are used to hold assembly components together, stress caused by rapidly changing loads often complicates the fastener's job. For example, under stress the investment in extra potential strength of an SAE grade five bolt is lost, and the quality of the entire machine lessened, if it is not properly tightened. Bolts not tightened properly may eventually loosen and fall out. Even bolts secured with a locking devise, may fail from fatigue. When a bolt is properly tightened, extra locking devices are unnecessary. For its cost, the heat treated SAE grade five bolt offers the greatest potential strength in standard production situations. But, to realize this potential, the bolt must be properly tightened.

A Few Standard Precautions

A few standard precautions will solve fastener problems. Since the fastener is usually the weakest link in any assembly, special attention is always necessary. This means that an incorrectly tightened fastener will fail before the machine itself fails. The job of determining proper bolt tightening. is simple. First, examine the bolt itself to determine its torque limits. Then check its maximum potential. Naturally, there are circumstances which will determine procedures and torque value for special situations but these are rare. Caution! Always consult manufacturers specifications when available. The most commonly used rule for determining proper torque for a fastener is to apply 70% of the torque necessary to cause failure. The ''Production Torque Guide'' chart in this manual indicates these values. Tightening to utilize the fastener's potential strength is a necessary part of the fastener story, but it isn't the whole story. Proper lubrication, washers, etc. are just as important as proper tightening, since as much as 80% of the torque applied to a fastener is lost through friction. When the relationship between torque and tension is out of control, reliability is out; therefore, proper lubrication is necessary to provide a constant clamping force over a series of applications.

The best lubrication is a high stress type, such as ''Never-Seez'' Compound. On non-critical applications, seventy-two hour zinc phosphate and oil coating may be used. This is an inexpensive coating and is furnished on many industrial fasteners direct from the manufacturer.

Also, the surface under the head of the bolt or under the nut (whichever is the turned member) is important. Many manufacturers use hard flat washers with no spring effect. The hardness contributes to good correlation between the torque applied and the tension achieved. The unbroken circular flatness contributes to dimensional control and consistency of clamping force from bolt to bolt. Locking devices offer some protection against improper tightening. One of the latest trends is the use of nuts with physical disrupted threads to insure fastener locking. This type of device is manufactured by several companies, but should be examined for it's own merits. (Remember, however, that galling can disrupt the torque-tension correlation when locking devices are used.)

CONVERSION OF VARIOUS UNITS OF TORQUE

Convert			Convert		
From	*To*	*Multiply*	*From*	*To*	*Multiply*
lb.in.	oz.in.	16	oz.in.	lb.in.	.0625
lb.in.	lb.ft.	.08333	lb.ft.	lb.in.	12
lb.in.	kg.cm.	1.1519	kg.cm.	lb.in.	.8681
lb.in.	kg.m.	.011519	kg.m.	lb.in.	86.81
lb.in.	N•m	.133	N•m	lb.in.	8.85
lb.in.	dN•m	1.13	dN•m	lb.in.	.885
lb.ft.	kg.m.	.1382	kg.m.	lb.ft.	7.236
lb.ft.	N•m	1.356	N•m	lb.ft.	.7376
N•m	dN•m	10	dN•m	N•m	.10
N•m	kg.cm.	10.2	kg.cm.	N•m	.09807
N•m	kg.m.	.102	kg.m.	N•m	9.807

HOW TO COMPUTE TORQUE WHEN USING ADAPTORS

If an adaptor or extension is attached to the square drive of a click-type torque wrench and this adds to its length, then the applied torque will be greater than the pre-set torque. A formula can be used to find what the preset-set torque should be in order to obtain the correct applied torque.

Here is the formula:

$$\text{Dial Reading or Pre-Set Torque} = \frac{\text{Torque Wrench Pull Point x Torque Desired}}{\text{Torque Wrench Pull Point + Extension Length}}$$

$$\text{This becomes: RS} = \frac{\text{A x T}}{\text{A + B}} \text{ when}$$

RS = Dial reading or torque setting of the wrench.
A = Distance from the center of the square drive of the torque wrench to the center of the handle grip pull point.
B = Length of the adaptor from the center of the square drive to the center of the nut or bolt. Use only the length which is parallel to the handle. See figure 1
T = Torque desired. This is the actual torque applied to the fastener.

Here is a typical problem: What should the setting be when ''A'' is 12'', ''B'' is 6'' and ''T'' is 30 lb. ft.

$$\text{RS} = \frac{\text{A x T}}{\text{A + B}} \text{ or } \frac{12 \times 30}{12 + 6} \text{ or } \frac{360}{18} \text{ or 20 pound foot}$$

Therefore 30 pound foot of Torque will be applied at the fastener when ''RS'' is 20 pound foot.

Note: If the torque wrench reads in pound foot, then ''T'' should also be in pound foot. ''T'' and ''RS'' should be in the same unit of measurement. ''A'' and ''B'' should also be the same unit of measurement.

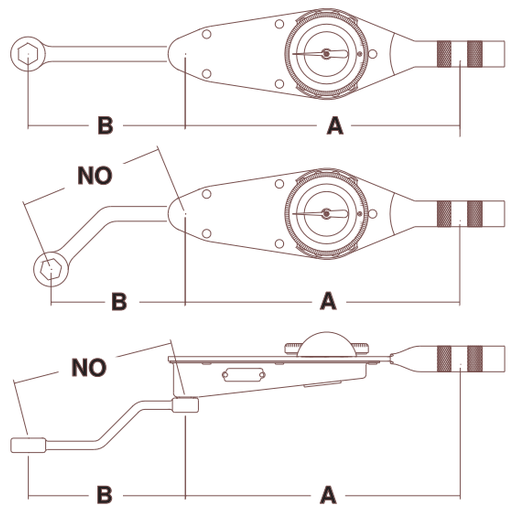

Figure 1 – Formula values for a Torque wrench

GENERAL TORQUE SPECIFICATION CHART FOR I.S.O.** METERIC FASTENERS*** (when SAE 10 oil is used as a lubricant)

Minimum Tensile Strength	kg/mm2	40		50		60			80	100	120
	P.S.I.	56900		71100			85340		113800	142200	170700
Proof Load	kg/mm2	22.6	29.1	28.2	36.4	33.9	43.7	47.5	58.2	79.2	95
	P.S.I.	32150	41390	40110	51770	48220	62160	67560	82780	112650	135130
Property Class		4.6	4.8	5.6	5.8	6.6	6.8	6.9	8.8	10.9	12.9
Bolt Diameter		Figures are KILOGRAM METER except those that are **bolded** which are KILOGRAM CENTENETER									
Metric	Inch										
6 mm	0.236	***49***	***63***	***61***	***79***	***74***	***95***	***103***	***126***	***172***	***206***
8 mm	0.315	***119***	***153***	***148***	***191***	***178***	***230***	***250***	***306***	***417***	***500***
10 mm	0.394	***235***	***303***	***294***	***379***	***353***	***455***	***495***	***606***	8.2	10
12 mm	0.472	***411***	***529***	***427***	***662***	***616***	7.9	8.6	10.5	14	17
14 mm	0.551	***654***	8.4	8.2	10.5	10	12	13	17	23	27
16 mm	0.63	10	13	12	16	15	20	21	26	36	43
18 mm	0.709	14	18	17	23	21	27	30	36	49	59
22 mm	0.866	27	35	34	44	41	52	57	70	95	114

*** NOTE: Use only when manufacturers specifications are not available, these values are for stiff metal-to-metal joints and are based on 90% of proof load. DO NOT USE for gasket joints or joints of soft materials

** I.S.O.= International Standardization Organization.

If Your Torque Wrench Needs Repair

1. Send it to an authorized Precision Instruments Service Center, or give it to your Precision Sales representative. Do not attempt to repair it yourself.
2. If the warranty is no longer in effect, your Precision Instruments Customer Service Representative will contact you with repair charges for your approval before being repaired.
3. A series of testers are available from Precision Sales for checking the accuracy of your Torque Wrench. See your Precision Sales representative for more information.

Precision Instruments, Inc. Sales (toll free): 866-TWRENCH
1846 Miner Street (866-897-3624)
P.O. Box 1367
Des Plaines, IL. 60017 Fax: 847-824-7629

E-mail us at: sales@torqwrench.com

Visit us at: **www.torqwrench.com**

Caution

Always use manufacturers specifications when available. These specifications are approximate and may not be appropriate for some applications. No liability is assumed for errors which may result from the use of any of these specifications.

GENERAL TORQUE SPECIFICATION CHART FOR I.F.I.* METRIC FASTENERS** (when SAE10 oil is used as a lubricant)

Minimum Tensile *** Strength Mpa		400	420	520	830	900	1040	1220
Proff Load MPa		225	310	380	600	650	830	970
Property Class		4.6	4.8	5.8	8.8	9.8	10.9	12.9
Bolt Diameter		Torque: Newton Metre						
metric	inch							
5mm	0.197	2.9	4	5	-	8	11	12
6mm	0.236	5	7	8	-	14	18	21
7mm	0.276	8	11	14	-	24	30	35
8mm	0.315	12	16	20	-	34	44	50
10mm	0.394	23	32	40	-	70	85	100
12mm	0.472	40	56	70	-	120	150	180
14mm	0.551	65	90	110	-	190	240	280
16mm	0.63	100	140	170	270	290	380	440
20mm	0.787	200	-	330	520	-	740	860
24mm	0.945	340	-	580	920	1260	1480	-
30mm	1.181	680	-	-	1820	-	2520	2940

*** Megapascal

** Note: Use only when manufacturers specifications are not available, these values are for stiff metal-to-metal joints and are based on 90% of proof load. DO NOT USE for gaskets joints or joints of soft materials. * I.F.I. = Industrial fasteners Institute.

THREADED FASTENER TENSION GUIDE

(Figures Represent Pounds of Clamping Force)

Stress Area	0.0091	0.0141	0.0175	0.0318	0.0524	0.0775	0.1063	0.1419	0.1819	0.226	0.3344	0.4617	0.6057	0.7632	0.9691	1.4052	1.8993	2.8917	4.5951
Outside Diameter	No.6	No.8	No.10	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"	1-1/8"	1-1/4"	1-1/2"	1-3/4"	2"	2-1/2"
Threads Per Inch	32	32	24	20	18	16	14	13	12	11	10	9	8	7	7	6	5	12	12
Torque: 5 lb.in.	205	157																	
10 lb.in.	410	316	315																
20 lb.in.	820	632	630	337															
40 lb.in.		1264	1264	674	541														
80 lb.in.				1348	1082	987													
10 lb.ft.				2043	1625	1482	1224												
20 lb.ft.				4092	3250	2964	2448	2143											
40 lb.ft.					6503	5928	4896	4286	3899										
80 lb.ft.						11857	9796	8572	7799	7065									
100 lb.ft.							12245	10716	9749	8832	7915								
125 lb.ft.								13395	12186	11049	9894								
150 lb.ft.								16091	14623	13261	11872								
175 lb.ft.									17061	15462	13851	12117							
200 lb.ft.									19498	17664	15830	13836	12113						
250 lb.ft.									24373	22100	19788	17296	15142	11985					
300 lb.ft.										26523	23745	20776	18170	14382	13247				
400 lb.ft.											31660	27700	24227	19176	17663				
500 lb.ft.											39576	34592	30284	23971	22079	19754			
750 lb.ft.												51941	45426	35956	33118	29631	22678		
1,000 lb.ft.													60569	47942	44158	39508	30238	31724	
1,500 lb.ft.														71985	66237	59262	45358	47587	36289
2,000 lb.ft.															88317	79017	60477	63449	48386
3,000 lb.ft.																118525	90716	95174	72579
5,000 lb.ft.																197543	151193	158624	120966
10,000 lb.ft.																	302387	317248	241932
20,000 lb.ft.																			483864

In some cases it may be desirable to know the total clamping force obtained for a given torque. Values are approximate. SAE 30 engine oil was used as lubricant. Use of high stress lube may increase value 20% or more. Highest values for a given size may only be obtained with heat treated bolts having minimum tensile strengths of 150,000 P.S.I. or more.

* Stress area is calculated as the area of the circle whose diameter is the mean between the root and pitch diameters. This closely approximates the actual stress condition. Maximum theoretical clamping force cannot be obtained from threaded fasteners. Additional stresses to the fastener are caused by the torsional forces of tightening.

PRODUCTION TORQUE GUIDE

Fastener	Type	Minimum Tensile Strength	Material	Body size of Outside Diameter																												
				2	3	4	5	6	8	10	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2	1-5/8	1-3/4	1-7/8	2	2-1/4	2-1/2	2-3/4	3
	S.A.E 2 Steel	74000 P.S.I	Low Carbon								6	12	20	32	47	69	96	155	206	310	480	675	900	1100	1470	1900	2360	2750	3450	4400	7350	9500
	S.A.E. 5 Steel	120000 P.S.I	Medium Carbon Heat Treat								10	19	33	54	78	114	154	257	382	587	794	1105	1500	1775	2425	3150	4200	4550	6550	7175	13000	16000
	S.A.E. 7 Steel	133000 P.S.I.	Medium Carbon Alloy								13	25	44	71	110	154	215	360	570	840	1325	1825	2500	3000	4000	5300	7000	7500	11000	15500	21000	27000
	S.A.E. 8 Steel	150000 P.S.I.	Medium Carbon Alloy								14	29	47	78	119	169	230	380	600	900	1430	1975	2650	3200	4400	5650	7600	8200	12000	17000	23000	29000
	Socket Head Cap Screw	160000 P.S.I.	High Carbon Quenched Tempered								16	33	54	84	125	180	250	400	640	970	1520	2130	2850	3450	4700	6100	8200	8800	13000	18000	24000	31000
	Socket Set Screw	212000 P.S.I.	High Carbon Quenched Tempered					**9***	**16***	**30***	**70***	**140***	18	29	43	63	100	146															
	Machine Screw Stainless		18-8	**2.6***	**4***	**5.5***	**8***	**10***	**20***	**23***	**75***	**132***	20	31	43	58	95	130	194	260	400	500		725								
	Machine Screw Stainless		316	**2.7***	**4***	**5.7***	**8***	**10***	**22***	**25***	**80***	**140***	22	34	46	60	100	135	210	280	425	515		750								
	Machine Screw Yellow Brass	60000 P.S.I.	CU 63 ZN 37	**2***	**3.3***	**4.4***	**6.4***	**8***	**16***	**20***	**65***	**110***	17	27	37	49	78	104	160	215	325	400		595								
	Silicone Bronze Type "B"	70000 P.S.I.	CU 96 ZNI-5 Min.	**2.3***	**3.7***	**4.9***	**7.2***	**10***	**19***	**22***	**70***	**125***	20	30	41	53	88	117	180	250	365	450		655								
	Machine Screw Aluminum	55000 P.S.I.	CU 3.8-4.9 1.2-1.8 MN .3-.9	**1.4***	**2.1***	**2.9***	**4.3***	**5.4***	**12***	**15***	**46***	**82***	13	20	27	36	62	83	128	170	255	315		460								
	Machine Screw Monel	82000 P.S.I.	NI 67 CU 30 FE 1.4	**2.5***	**4***	**5.5***	**8***	**11***	**21***	**27***	**87***	**155***	23	36	50	67	115	155	235	315	475	585		850								
	Sems Heat Treated Steel	120000 P.S.I.	1018 1022	**4***	**5***	**7***	**11***	**15***	**27***	**37***	**90***	**200***	**330***																			
	Studs	Use SAE 2.5 and 8 values when grade is known, with nut of sufficient strength.																														
	Tapping Screw	Set up joint as it will be in production use 70% of over-torque failure as production specifications.																														

All figures are POUND FEET except those marked with an **ASTERISK (*)** WHICH ARE pound inches. These values are for lubricated fasteners.

PRECISION INSTRUMENTS

Zeroing the Precision Instruments D-Line Dial-Type Torque Wrench

The wrench is shipped with the main pointer lined up on the zero mark and pointing straight forward.

If the main pointer ever comes to rest at an angle other than straight forward, hold the outer dial ring with your index finer and thumb...

And turn the outer dial ring to line up the main pointer with the zero mark. Note: This will <u>not</u> affect the calibration of the tool.

IN1247 10/07

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